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Ego Depletion—Is It All in Your Head? Implicit Theories About Willpower Affect Self-Regulation

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Abstract

Much recent research suggests that willpower—the capacity to exert self-control—is a limited resource that is depleted after exertion. We propose that whether depletion takes place or not depends on a person's belief about whether willpower is a limited resource. Study 1 found that individual differences in lay theories about willpower moderate ego-depletion effects: People who viewed the capacity for self-control as not limited did not show diminished self-control after a depleting experience. Study 2 replicated the effect, manipulating lay theories about willpower. Study 3 addressed questions about the mechanism underlying the effect. Study 4, a longitudinal field study, found that theories about willpower predict change in eating behavior, procrastination, and self-regulated goal striving in depleting circumstances. Taken together, the findings suggest that reduced self-control after a depleting task or during demanding periods may reflect people's beliefs about the availability of willpower rather than true resource depletion.

Keywords

implicit theories, self-control, self-regulation, ego depletion

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Some of the most provocative and influential research of the past decade has investigated the *strength model of self-control* (e.g., Baumeister, Bratlavsky, Muraven, & Tice, 1998; Baumeister, Vohs, & Tice, 2007). This model suggests that acts of self-regulation consume a resource that is limited, leaving people in a state of *ego depletion* and making them less able to exert self-control on a subsequent task. The strength model of self-control accounts for an impressive array of empirical findings, including depletion effects on information processing (Fischer, Greitemeyer, & Frey, 2008), intellectual performance (Schmeichel, Vohs, & Baumeister, 2003), impression management (Vohs, Baumeister, & Ciarocco, 2005), and violent responses to provocation by a partner (Finkel, DeWall, Slotter, Oaten, & Foshee, 2009).

Some research, however, suggests that the exertion of self-control does not invariably reduce subsequent self-control (Moller, Deci, & Ryan, 2006; Tice, Baumeister, Shmueli, & Muraven, 2007). For instance, people who are motivated by incentives to control themselves may not show ego-depletion effects (Muraven & Slessareva, 2003). Most relevant to the present research are findings that expectancies about diminished self-control following exertion can moderate ego depletion. In one study, some participants were told that performing an effortful task (controlling their emotions) could improve performance on a subsequent task (Martijn, Tenbült, Merckelbach, Dreezens, & de Vries, 2002). These participants showed no decrease in subsequent self-control performance (squeezing a handgrip).

Here, we ask a more general question: Does holding a global theory that difficult tasks are energizing rather than depleting prevent ego depletion and help people sustain self-regulation? Specifically, we report a set of studies that tested whether people's implicit theories about self-control moderate ego-depletion effects. Much research documents the effects of implicit theories on self-related processes. These theories include beliefs about the nature of human attributes, such as whether intelligence and personality are fixed or malleable (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 1999; Molden & Dweck, 2006). In the context of self-regulation, we propose that people differ in their implicit theories about the availability and depletability of self-control resources

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(or their "willpower"). Some people may think that self-control is a limited resource, as described in the strength model of self-control. Others may believe that self-control is not limited and perhaps even that engaging in a strenuous task can activate self-control resources. We call these the *limited-resource theory* and the *nonlimited-resource theory*, respectively. We suggest that these theories affect how well people self-regulate when demands on self-control accumulate.

Overview of the Studies

Three experiments and a longitudinal study tested the effect of implicit theories about willpower on ego depletion. The first studies, using a traditional ego-depletion paradigm, measured (Study 1) and manipulated (Study 2) implicit theories to test the hypothesis that implicit theories moderate ego depletion. Study 3 examined mechanisms involved in the findings from Studies 1 and 2. For example, one possibility based on the strength model of self-control is that people given a nonlimited-resource theory perform well on a postdepletion task because they "overuse" their resources, whereas those given a limited-resource theory conserve and replenish their resources (Baumeister & Vohs, 2007). If so, on a third demanding task, people given the limited-resource theory should perform better than those given the nonlimited-resource theory (Muraven, Shmueli, & Burkley, 2006). Study 3 also tested whether, following a demanding task, people with the nonlimited-resource theory felt less exhausted than those with the limited-resource theory or experienced the same level of exhaustion but were less affected by exhaustion. Finally, Study 4 examined the effect of implicit theories on self-regulation during a time of high self-regulatory demands (i.e., during students' final exams).

Study 1

Study 1 investigated whether individual differences in implicit theories about willpower moderate ego depletion.

Method

Participants. Sixty students (42 females, 18 males) participated in a "study on stimulus detection and cognitive processing" in exchange for course credit or $10.

Materials and procedure. First, participants completed six items assessing implicit theories about willpower, specifically, their theories about the effects of mental exertion. So as not to arouse suspicion, the measure was embedded among several other implicit-theory measures (e.g., theories of personality and of intelligence). Items included "After a strenuous mental activity your energy is depleted and you must rest to get it refueled again" (limited-resource theory) and "Your mental stamina fuels itself; even after strenuous mental exertion you can continue doing more of it" (nonlimited-resource theory). Participants responded using a 6-point rating scale (1 = *strongly agree*, 6 = *strongly disagree*). Table S1, in the Supplemental Material available online, presents the full scale. Items were scored so that higher values represent greater agreement with the limited-resource theory. The scale was reliable (α = .89), so the scores on the six items were averaged (M = 4.13, SD = 0.84).

Participants then completed a "stimulus detection task." This task was adopted from previous research to manipulate ego depletion (Baumeister et al., 1998; Tice et al., 2007; Wheeler, Briñol, & Hermann, 2007). It consisted of two parts, each lasting 5 min. First, all participants were instructed to cross out each *e* on a page of typewritten text. This task establishes a behavioral pattern. Second, on a second page, some participants (nondepleting condition) were again instructed to cross out every *e*. Others (depleting condition) were asked to follow complex rules that sometimes required them to inhibit the previously established response (e.g., not to cross out an *e* followed by a vowel).

Next, participants completed a standard measure of ego depletion—a Stroop task (Gailliot et al., 2007; Inzlicht, McKay, & Aronson, 2006; Webb & Sheeran, 2003). Color words (*red*, *green*, *yellow*, and *blue*) appeared on a computer screen in a font color that was either congruent or incongruent with their meaning. Participants completed 48 trials (24 incongruent). In each, they were instructed to press a key marked with the color the word was written in. The Stroop task is a widely used measure of self-control because on incongruent trials, the meaning of the word interferes with naming its color and has to be suppressed for accurate identification of the font color. Previous research has found ego-depletion effects on performance on incongruent Stroop trials and not on congruent trials (Inzlicht & Gutsell, 2007). Therefore, the primary outcome was accuracy on incongruent trials.[1]

Results and discussion

Accuracy on each incongruent Stroop trial was coded (correct = 0, incorrect = 1). We then fit a logistic curve for each participant using a logistic hierarchical linear model (HLM). HLM allowed us to control for covariates at the trial level and thus provides a more precise estimate of participants' latent probability of responding accurately than analysis of variance or regression would have. Participants were more accurate when they took longer to respond, and they became more accurate as they completed more trials. To control for extraneous variation caused by speed-accuracy trade-offs and order effects, we included reaction time and trial order as trial-level predictors in each model.

Participant-level predictors were ego-depletion condition (nondepleting = 0, depleting = 1), implicit theories about willpower (centered), and their interaction term.[2] There was a main effect of ego-depletion condition, β = 0.36, odds ratio (OR) = 1.44, $t(1433) = 6.71$, $p < .01$. Participants were more likely to make mistakes on the Stroop task after the depleting task than after the nondepleting task, a finding that replicates past research. However, as predicted, this main effect was

qualified by an interaction with implicit theories, β = 0.28, *OR* = 1.32, *t*(1433) = 3.88, *p* < .01. As displayed in Figure 1, only participants with a limited-resource theory (+1 *SD*) showed the usual ego-depletion pattern, making more mistakes after the depleting task. Participants with a nonlimited-resource theory (–1 *SD*) showed no difference in accuracy between the depleting and nondepleting conditions.

To analyze the interaction, we conducted separate HLM models for participants with a limited-resource theory and those with a nonlimited-resource theory.[3] These analyses confirmed that the difference between the depleting and the nondepleting condition was significant for participants with a limited-resource theory, β = 0.63, *OR* = 1.88, *t*(739) = 8.27, *p* < .01, and nonsignificant for participants with a nonlimited-resource theory, β = 0.04, *OR* = 1.04, *t* < 1.

The results support the hypothesis that implicit theories about willpower moderate ego depletion. Only participants with a limited-resource theory showed ego depletion. Participants with a nonlimited-resource theory showed no difference between the depleting and nondepleting conditions.[4]

Study 2

In Study 2, we manipulated implicit theories about willpower to test their causal effect.

Method

Participants. Forty-six students (27 females, 19 males) participated in exchange for course credit or $10.

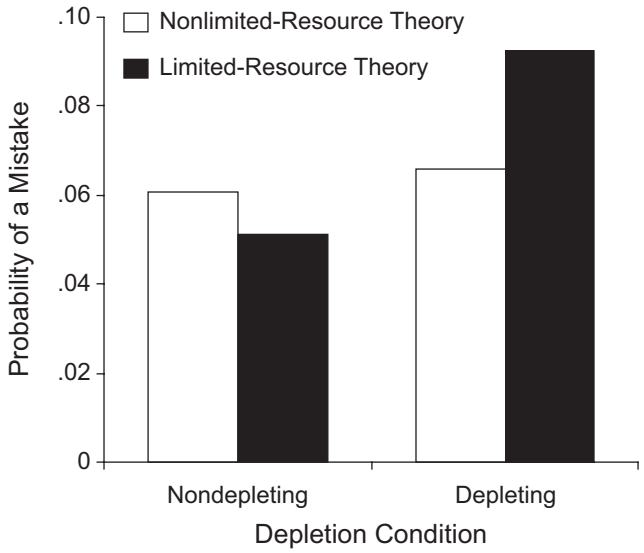

Fig. 1. Results from Study 1: probability of making a mistake on incongruent trials of the Stroop task as a function of ego-depletion condition and implicit theories about willpower. The limited-resource-theory group represents participants 1 standard deviation above the mean on the implicit-theories measure. The nonlimited-resource-theory group represents participants 1 standard deviation below the mean on the implicit-theories measure.

Procedure. First, we manipulated implicit theories about willpower. Participants completed a biased questionnaire containing nine items formulated to foster agreement with either a limited-resource theory (e.g., "Working on a strenuous mental task can make you feel tired such that you need a break before accomplishing a new task") or a nonlimited-resource theory (e.g., "Sometimes, working on a strenuous mental task can make you feel energized for further challenging activities"). Participants responded on a 6-point scale (1 = *strongly agree*, 6 = *strongly disagree*; α = .84). One-sample *t* tests comparing the mean in each condition with the scale's midpoint (3.50) indicated that participants agreed with the suggested theory in both the limited-resource-theory condition (*M* = 2.27, *SD* = 0.69), *t*(23) = –8.74, *p* < .01, and the nonlimited-resource-theory condition (*M* = 2.80, *SD* = 0.68), *t*(21) = –4.78, *p* < .01.

The rest of the study was identical to Study 1. Participants completed what was described as a stimulus detection task (which contained the ego-depletion manipulation) and then the Stroop task.

Results and discussion

We ran a logistic HLM model with accuracy of responses on incongruent Stroop trials as the dependent variable (correct = 0, false = 1), again controlling for reaction time and order. Predictor variables were ego-depletion condition (nondepleting = 0, depleting = 1), implicit-theory condition (nonlimited-resource theory = 0, limited-resource theory = 1), and their interaction. As predicted, the interaction was significant, β = 1.15, *OR* = 3.17, *t*(1097) = 8.47, *p* < .01. As displayed in Figure 2, only participants led to adopt the limited-resource theory showed ego depletion, making more mistakes after the depleting task than after the nondepleting task. The opposite pattern emerged for participants in the nonlimited-resource-theory condition. Separate analyses of the two groups found that the difference between the depleting and nondepleting conditions was significant (though in opposite directions) in both the limited-resource-theory condition, β = 0.72, *OR* = 2.06, *t*(571) = 10.53, *p* < .01, and the nonlimited-resource-theory condition, β = –0.42, *OR* = 0.66, *t*(523) = –4.35, *p* < .01.

The results show that manipulated theories about willpower as either a limited or a nonlimited resource moderate ego depletion, confirming that the moderating role of implicit theories about willpower is causal. Interestingly, participants who had been induced to hold a nonlimited-resource theory performed worse after the nondepleting task than after the depleting task. It is intriguing to speculate that they were "depleted" by boredom rather than by self-control, though this effect needs to be replicated in future research.

Study 3

Study 3 was designed to test whether the findings of Study 2 would be replicated and to shed light on possible mechanisms

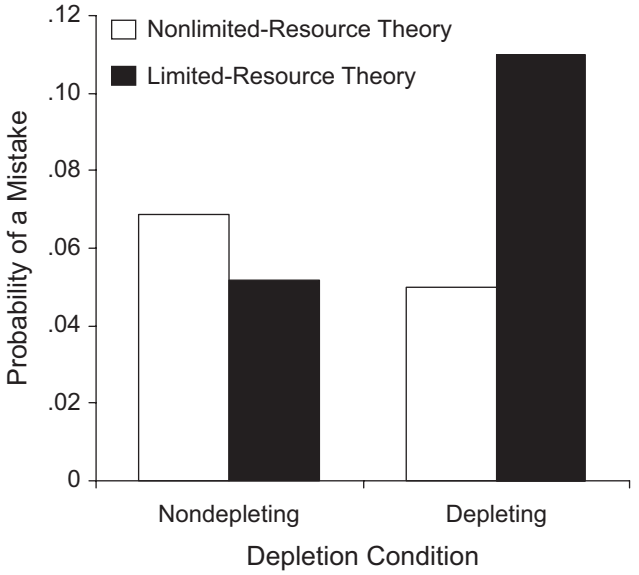

Fig. 2. Results from Study 2: probability of making a mistake on incongruent trials of the Stroop task as a function of ego-depletion condition and implicit-theory condition.

underlying the observed effect. First, we tested whether participants with a nonlimited-resource theory "overuse" their resources on the task following the depletion manipulation, leaving them depleted for a third task (see Muraven et al., 2006). Therefore, we assessed performance on two successive tasks after the depletion manipulation—Stroop performance and IQ performance. Second, we examined participants' subjective experience of exhaustion. We tested (a) whether implicit theories about willpower changed the degree to which the initial self-control task was experienced as exhausting and (b) whether implicit theories changed the degree to which the subjective experience of the task as exhausting undermined subsequent performance.

Method

Participants. Seventy-seven students (53 females, 24 males) participated in exchange for course credit or $10.

Procedure. Participants were randomly assigned to complete one of the two versions of the biased questionnaire used in Study 2. Next, they completed the *e*-crossing task containing the depletion manipulation. This task was followed by a question assessing subjective exhaustion: "How exhausting was the stimulus detection task for you?" (1 = *not at all*, 9 = *very much*). Participants then completed the Stroop task. Finally, they completed eight challenging IQ problems, as previous research has shown that intellectual performance is particularly sensitive to ego depletion (Schmeichel et al., 2003). In each problem, participants were given 20 s to select which of five figures best fit in a series of figures.[5]

Results and discussion

We ran the same logistic HLM model described in Study 2 on Stroop performance. The interaction between implicit-theory condition and ego-depletion condition was significant, $\beta = 0.25$, $OR = 1.29$, $t(1842) = 2.62$, $p < .01$. As displayed in Figure 3a, participants in the limited-resource-theory condition exhibited ego depletion, making more mistakes after the depleting task than after the nondepleting task. There was no difference between ego-depletion conditions for participants in the nonlimited-resource-theory condition. Separate analyses for the two implicit-theory groups found that the difference between the nondepleting and depleting conditions was significant in the limited-resource-theory condition, $\beta = 0.59$, $OR = 1.81$, $t(979) = 8.59$, $p < .01$, but not in the nonlimited-resource-theory condition, $t(859) < 1$.

Analysis of IQ performance yielded the same pattern. The interaction between implicit-theory condition and ego-depletion condition was significant, $\beta = 0.48$, $OR = 1.62$, $t(610) = 2.81$, $p < .01$. As displayed in Figure 3b, participants in the limited-resource-theory condition made more mistakes after the depleting task than after the nondepleting task, $\beta = 0.33$, $OR = 1.39$, $t(324) = 2.85$, $p < .01$. The performance of participants in the nonlimited-resource-theory condition did not vary by depletion condition, $t(284) < 1$.

Next, we examined subjective exhaustion. First, we tested whether theories about willpower affected participants' experience of exhaustion. We conducted a 2 (implicit-theory condition) × 2 (ego-depletion condition) analysis of variance. Only the main effect of ego-depletion condition was significant, $F(1, 76) = 8.17$, $p < .01$, $\eta^2 = .10$. Participants experienced the *e*-crossing task as more exhausting in the depleting condition ($M = 4.59$, $SD = 2.29$) than in the nondepleting condition ($M = 3.31$, $SD = 2.03$). Neither the main effect of implicit-theory condition nor the interaction was significant, Fs < 1. Thus, the induced theory of willpower did not affect the degree to which participants experienced the *e*-crossing task as exhausting.

Second, we tested whether theories about willpower moderated the relationship between felt exhaustion and subsequent performance. We ran the same logistic HLM model on Stroop performance as initially, but replacing ego-depletion condition with self-reported exhaustion (centered). The interaction between self-reported exhaustion and implicit-theory condition was significant, $\beta = 0.17$, $OR = 1.19$, $t(1842) = 3.58$, $p < .01$ (see Fig. 3c). Separate analysis for each implicit-theory condition showed that greater self-reported exhaustion predicted more mistakes in the limited-resource-theory condition, $\beta = 0.09$, $OR = 1.09$, $t(979) = 6.18$, $p < .01$, but not in the nonlimited-resource-theory condition, $t(859) < 1$. We conducted the same analyses on IQ performance. Again, the interaction was significant, $\beta = 0.22$, $OR = 1.25$, $t(610) = 2.67$, $p < .01$.

Finally, we examined whether the altered relationship between exhaustion and performance mediated the effect of implicit theories on ego depletion (see Fig. 4). We ran logistic HLM models with Stroop and IQ performance as dependent

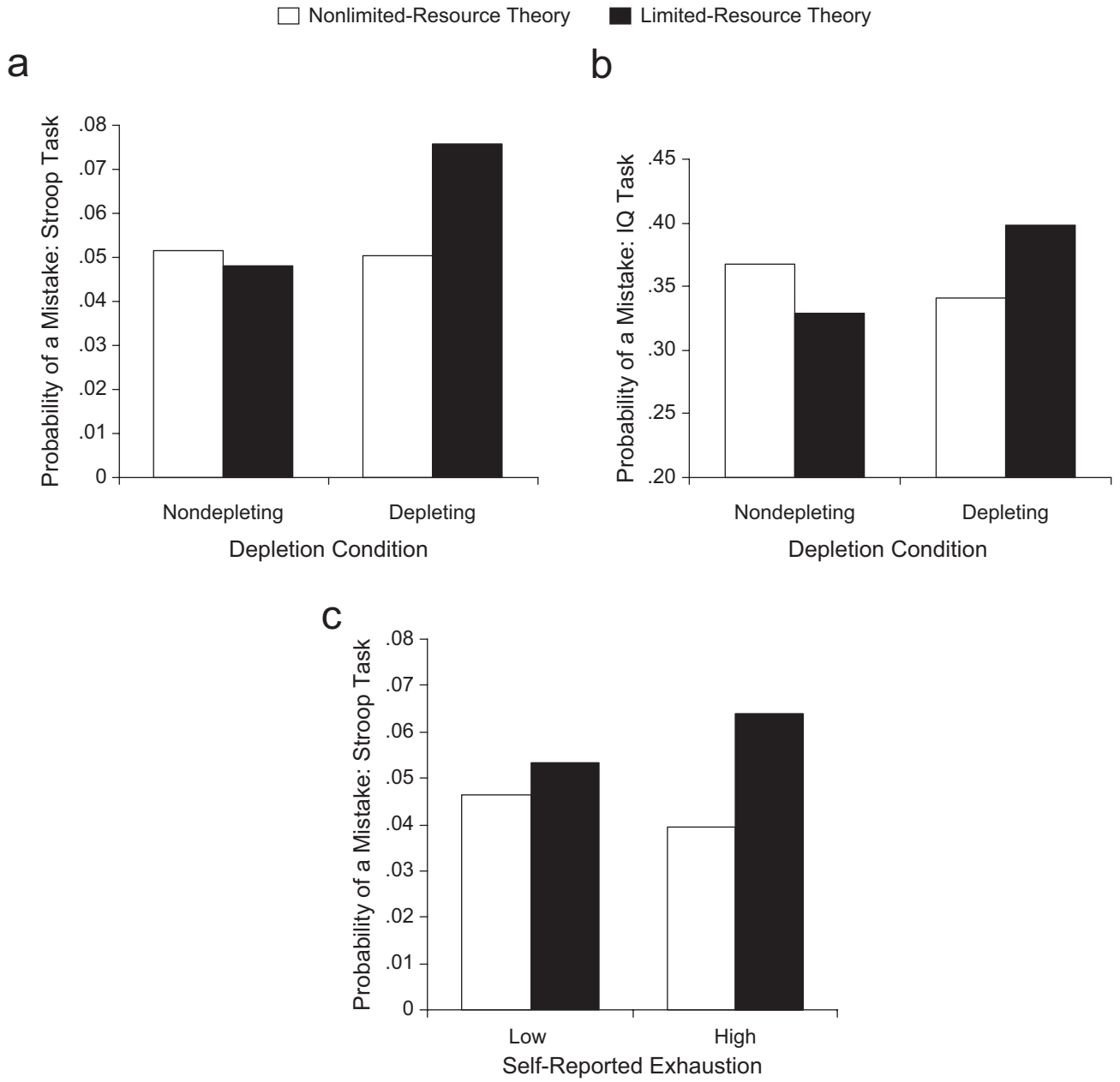

Fig. 3. Results from Study 3: probability of making a mistake on (a) incongruent trials of the Stroop task and (b) the IQ task as a function of ego-depletion condition and implicit-theory condition and (c) probability of making a mistake on incongruent trials of the Stroop task as a function of experienced exhaustion and implicit-theory condition. Low and high exhaustion represent participants 1 standard deviation below and above the mean, respectively.

variables. Predictors were the two experimental conditions (implicit-theory and ego-depletion conditions), their interaction, self-reported exhaustion, and the interaction between self-reported exhaustion and implicit-theory condition. For accuracy on the Stroop task, the interaction between self-reported exhaustion and implicit-theory condition remained significant, $\beta = 0.18$, $OR = 1.20$, $t(1840) = 3.55$, $p < .01$, but the interaction between ego-depletion condition and implicit-theory condition was no longer significant, $\beta = 0.14$, $OR = 1.15$, $t(1840) = 1.56$, $p > .10$, Sobel test: $z = 2.20$, $p < .05$. Similarly, for accuracy on the IQ problems, only the interaction between self-reported exhaustion and implicit-theory condition remained significant when both self-reported exhaustion and ego-depletion condition were included in the analysis, $\beta = 0.19$, $OR = 1.21$, $t(609) = 2.15$, $p < .05$. The results suggest that self-reported exhaustion in interaction with the induced resource theory mediated the Ego-Depletion Condition × Implicit-Theory Condition effect on both Stroop performance and IQ performance.

In sum, Study 3 yielded no evidence that a nonlimited-resource theory led participants to overuse self-control

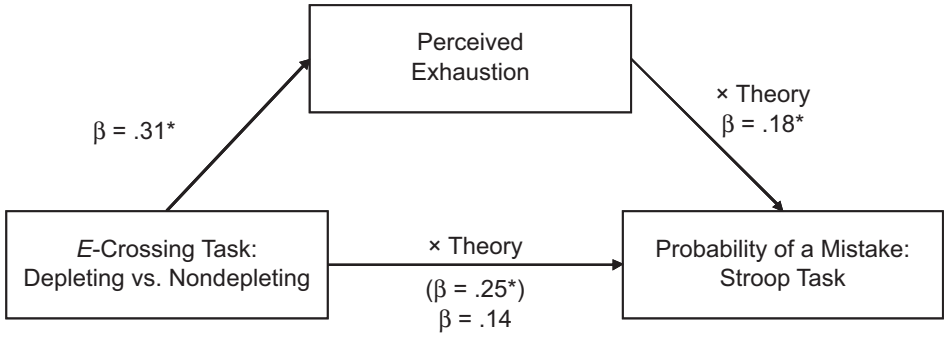

Fig. 4. Analysis of self-reported exhaustion as a mediator of the interactive effect of ego-depletion condition and implicit-theory condition on Stroop performance. Asterisks indicate significant coefficients (*$p < .01$). In the bottom path, the beta in parentheses refers to the analysis without the mediator.

resources. After a depletion manipulation, participants in the nonlimited-resource-theory condition showed no evidence of resource depletion even on a series of tasks. Further, theories about willpower did not affect the experience of the depleting task as exhausting. Instead, these theories affected the relationship between the experience of exhaustion and subsequent performance. People with a nonlimited-resource theory experienced the depleting task as just as exhausting as those with a limited-resource theory, but for them, exhaustion did not undermine subsequent performance.

Study 4

Studies 1 through 3 showed that measured and induced theories about willpower as a limited versus nonlimited resource moderate ego depletion in a classic laboratory paradigm. Study 4 examined the effect of implicit theories about willpower on people's everyday self-regulation and goal striving. Given our previous findings, we hypothesized that the nonlimited-resource theory, compared with the limited-resource theory, would predict better self-regulation during times of heightened stress and self-regulatory demands. Therefore, we tracked college students across three time points, the last of which was during final exams. We expected implicit theories about willpower at the second time point to predict self-regulation during final exams, but we did not expect implicit theories to predict self-regulation at the prior time points, when self-regulatory demands were lower.

Method

Participants and procedure. An initial Web questionnaire was completed by 101 undergraduates in April, at the beginning of the academic quarter (Time 1, or T1). Of these participants, a subsample of 44 completed measures at the second time point, in May (T2). In the critical comparison, 41 of those 44 participants (30 women, 11 men) also completed measures at the third time point, during final exams in the first week of June (T3). Participants in the final sample did not differ on any measure from participants who completed measures at T1 but did not continue in the study.

Measures. The same measures were assessed at each time point. First, we assessed individual differences in implicit theories about willpower using 12 items: the 6 items used previously plus 6 items that assessed resistance to temptation as a further aspect of self-control (see Table S1). Items were coded so that higher values represent agreement with a limited-resource theory. The scale was internally reliable, $\alpha(T1) = .77$, $\alpha(T2) = .86$, $\alpha(T3) = .89$, and showed high reliability over time (test-retest rs $> .77$).

Second, we assessed participants' everyday efforts at self-regulation by examining reported consumption of unhealthy foods and reported procrastination. Participants were asked how often in the previous week they had consumed several high-fat or high-sugar foods and drinks. They were also asked how often they had engaged in various nonacademic activities rather than studying (e.g., "How often did you watch TV instead of studying?"). Responses were made on 7-point scales (1 = *never*, 7 = *two or more times per day*).

Third, we assessed self-regulation with respect to a personal goal using a procedure developed by Brunstein, Schultheiss, and Grässmann (1998). At T1, participants listed a personal goal that involved challenge and achievement. This goal was presented to participants at each time point, and they were asked how well they had regulated themselves in pursuing it (five items, e.g., "I was often not in the mood to do something for this goal"; 1 = *strongly disagree*, 5 = *strongly agree*), $\alpha(T1) = .69$, $\alpha(T2) = .86$, $\alpha(T3) = .81$.

Results and discussion

The hypothesis that implicit theories about willpower affect self-regulation when demands on self-regulation are high implies that a limited-resource theory at T2 should predict worse self-regulation at T3. To test this hypothesis, we regressed self-regulation variables at T3 on implicit theories at T2, controlling for self-regulation at T2. These analyses revealed that a limited-resource theory at T2 predicted worse self-regulation on all three measures at the stressful time point, T3—consumption of unhealthy food: $b = 0.41$, $\Delta R^2 = .16$, $\Delta F(1, 38) = 11.76$, $p < .01$; procrastination rather than studying: $b = 0.29$, $\Delta R^2 = .08$, $\Delta F(1, 38) = 8.11$, $p < .01$; and

self-regulation with respect to personal goal striving: $b = -0.27$, $\Delta R^2 = .06$, $\Delta F(1, 38) = 5.80$, $p < .05$. A limited-resource theory at T2 also predicted lower scores on a composite of all three self-regulation measures at T3 (created by reverse-scoring personal-goal self-regulation and then standardizing and averaging the three indicators), $b = 0.51$, $\Delta R^2 = .20$, $\Delta F(1, 38) = 24.71$, $p < .001$. The more participants agreed with a limited-resource theory at T2, the more they reported eating unhealthy food, procrastinating, and self-regulating ineffectively while pursuing an important goal at T3.

Next, we tested the reverse causal relationship—from self-regulation at T2 to implicit theories at T3. Implicit theories at T3 were regressed on T2 self-regulation, controlling for T2 implicit theories. There was no significant relationship between any T2 self-regulatory variable and T3 implicit theories, ΔFs$(1, 38) < 1.30$.

The same analyses were repeated with the same sample using self-regulation variables and implicit theories at T1 and T2. As predicted, no relationship in either direction was significant.

The results support the hypothesis that the nonlimited-resource theory of willpower, compared with the limited-resource theory, predicts better self-control during periods of heightened stress and self-regulatory demands. Of course, the results do not imply that a nonlimited-resource theory will always produce better self-regulation. In times of low stress, the limited-resource theory could prove superior (see Study 2).

General Discussion

In a classic laboratory paradigm, only people who thought of or who were led to think of willpower as a limited resource showed ego depletion (Studies 1–3). By contrast, for people who had or were led to adopt a nonlimited-resource theory, a demanding initial task did not undermine subsequent performance. In one study, the demanding task actually raised their subsequent performance. Further, Study 4 showed that the more people held a limited-resource theory, the poorer was their self-regulation in the real world when demands on self-regulation were high.

According to the strength model of self-control, motivational factors that counteract ego-depletion effects (e.g., incentives or expectancies) may do so because motivation can compensate for a lack of self-regulatory strength to some degree (Baumeister & Vohs, 2007; Muraven et al., 2006). It is argued that this motivation can lead people to expend more of the depleted psychological resource, leaving less available for subsequent tasks. This process did not account for the effects of implicit theories about willpower. In Study 3, people led to adopt a nonlimited-resource theory performed better than people with a limited-resource theory not only on the task immediately following the depleting task (the Stroop task), but also on a third task (IQ problems).

Study 3 also suggests a mechanism for ego depletion and for how implicit theories sustain self-control. Perceived exhaustion mediated the effects of the depletion manipulation in the limited-resource condition. This finding is consistent with research showing that depletion effects are better predicted by people's perception of depletion than by an actual depletion experience (Clarkson, Hirt, Jia, & Alexander, 2010). The present research suggests that implicit theories changed how people responded given their level of felt exhaustion on the initial task. People led to adopt a limited-resource theory performed worse the more exhausted they felt. But for people led to adopt a nonlimited-resource theory, there was no relationship between perceived exhaustion and subsequent performance. For them, exhaustion was not a sign to reduce effort.

Taken together, the results suggest that in some cases, ego depletion may result not from a true lack of resources after an exhausting task, but from people's beliefs about their resources. We do not question that biological resources contribute to successful self-control (Gailliot & Baumeister, 2007; Gailliot et al., 2007). But these resources may be less limited than is commonly supposed. A key direction for future research is to examine how top-down processes (e.g., theories about willpower) and bottom-up processes (e.g., the availability of glucose) interact to affect self-control.

Psychological research has the power to shape how people think about themselves (Herman, 1996). People who learn about the strength model of self-control may conclude that they are at the mercy of a fixed, physiological process that limits their willpower. It is important that people understand that their own beliefs about willpower as a limited or nonlimited resource can affect their self-regulation. It is also important that psychologists appreciate the impact of powerful and widely shared lay theories about the self and distinguish their effects from seemingly immutable biologically driven processes.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

Notes

1. In all three studies using the Stroop task, the described pattern of results held when we combined incongruent and congruent trials but, as expected, not when only congruent trials were analyzed.

2. Age (centered) was included as a covariate on the participant level in all three studies using the Stroop task, given research showing that it relates to Stroop performance. All analyses used the population-average model.
3. These two groups were created using a median split to allow for the calculation of contrasts within HLM.
4. A possible alternative explanation is that people with a nonlimited-resource theory have better self-control than people with a limited-resource theory. However, a pilot study ($N = 65$) did not find a negative relationship between a limited-resource theory and trait self-control (Schwarzer, Diehl, & Schmitz, 1999), $r = .17$, $p > .20$.
5. To test whether effort took on a different (positive vs. negative) meaning for the two implicit-theory groups, we administered a brief word categorization task following the depletion manipulation. The task did not yield clear results and so is not discussed further.

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